EPA/ROD/R04-96/276
1996

EPA Superfund
Record of Decision:

FCX, INC. (STATESVILLE PLANT)
EPA ID: NCD095458527
OU 03
STATESVILLE, NC
09/30/1996

FCX-STATESVILLE
SUPERFUND SITE

RECORD OF DECISION
OPERABLE UNIT THREE

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U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ATLANTA, GEORGIA

SEPTEMBER 1996

DECLARATION
FOR
THE RECORD OF DECISION

SITE NAME AND LOCATION

FCX-Statesville (Operable Unit Three)
Statesville, Iredell County, North Carolina

STATEMENT OF BASIS AND PURPOSE

This decision document presents the Operable Unit Three Remedial Action for the FCX-Statesville Superfund Site (the "Site") in Iredell County, North Carolina, chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 and, to the extent practicable, the National Contingency Plan. This decision is based on the administrative record file for this Site.

The Superfund Section of the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR) concurs with the selected remedy for Operable Unit Three. Comments from the NCDEHNR on the Record of Decision, as well as EPA's responses to those comments, can be found in Appendix A of this document.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The Operable Unit Three Remedial Action addresses the portion of the soils and groundwater contamination associated with the property currently owned and operated by Burlington Industries. Soil and groundwater contamination associated with the FCX property will be addressed with the Operable Unit One and Two Remedial Actions. The Remedial Designs for Operable Units One and Two have been completed, and the Remedial Actions will be implemented as soon as funding is made available.

The major components of the Operable Unit Three Remedial Action include:

SOIL

Treatment of soil contaminated with volatile organic compounds using the Soil Vapor Extraction technology in order to reduce and minimize the potential adverse impacts to groundwater on and around the property currently owned and operated by Burlington Industries.

GROUNDWATER

Treatment of groundwater contaminants of concern, mainly volatile organic compounds, using the Air Sparging technology, to meet Federal Maximum Contaminant Levels (MCLs) or the North Carolina Groundwater Standards, whichever are more protective;

Monitoring of groundwater entering and exiting the treatment system, as well as monitoring of the groundwater quality on and around the textile facility for evidence that natural attenuation is happening, for an estimated 30 years, or until the performance standards have been met; and

The use of institutional controls including deed restrictions in the affected area to prohibit the consumption of contaminated groundwater associated with the property currently owned and operated by Burlington Industries, will be determined during the Remedial Design.

ADDITIONAL SAMPLING AND MONITORING

The installation of additional monitoring wells will be required during the Remedial Design to further characterize the nature and extent of groundwater contamination. Additional aquifer tests may also be needed in order to properly design the remedy described in this document.

In order to establish a broader database on groundwater quality and to maintain a level of protection for private well users living downgradient from the Site, samples will be collected and analyzed prior to implementation of the Remedial Action.

Periodic sampling of the surface water and sediment will be required to ensure that the quality of the groundwater discharging into the seep meets North Carolina surface water standards.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the Remedial Action, and is cost-effective.

This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume of site-related contaminants as a principal element.

Since this remedy may result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of the Operable Unit Three Remedial Action to ensure that the remedy continues to provide adequate protection of human health and the environment. Subsequent five-year reviews will be conducted for the duration of the Operable Unit Three Remedial Action.

FCX-STATESVILLE
OPERABLE UNIT THREE

FINAL RECORD OF DECISION

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A. Introduction

The textile facility currently owned and operated by Burlington Industries, located on Phoenix Street just to the north of the FCX property, is the subject of the Operable Unit Three Remedial Investigation.

B. Site Description

The textile facility is approximately 15 acres in size. Two large buildings consisting of a warehouse (approximately 60,000 square feet in size) and the main building (approximately 275,000 square feet in size) are present on-site. In addition, and underground storage tank area with three 30,000-gallon tanks storing #6 fuel oil, a fire water supply tank, and two pollution control units are present. The majority of the textile property is covered by either buildings or paved areas. See Figure 1.

C. Topography

The Site is situated in the Piedmont physiographic province in western-central North Carolina. The Piedmont physiographic province surrounding the Site is characterized as gently rolling and sloping, with slopes on-site ranging up to 1.5 percent. Slopes in the immediate vicinity of the Site range from 2 to 6 percent. Elevations within a four-mile radius of the Site range from 740 to 970 feet above mean sea level.

D. Geology/Hydrogeology

The Site lies within the geologic belt know as the Blue Ridge-Inner Piedmont Belt. The Blue Ridge-Inner Piedmont Belt generally consists of metamorphic rocks including gneisses and schists, as well as gradations of the two types. Most of these rocks near the surface have weathered into a layer of "overburden" overlying the fractured but relatively unweathered bedrock. In general, soils encountered during drilling activities at the OU 3 study areas were predominantly red brown to tan clayey and sandy silts (ML) according to the Unified Soil Classification System (ASTMD 2488-84).

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Ground water in the Statesville area is found in the clayey and sandy soil which is residual weathered material (saprolite), and in underlying weathered and fractured bedrock. The surface of the water table usually occurs in the saprolite and is often a subdued replica of the topography. Water table elevations are usually highest beneath hilltops, which are recharge areas, and lowest in the stream valleys, which are discharge areas. There are noticeable fluctuations in the water table with the changing seasonal climatic conditions. The water table usually begins to decline in April or May with the onset of the plant growing season. This decline in water levels continues until the end of the growing season in November and December.

Water enters the ground water system as percolating rain water in recharge areas and flows through the system to discharge areas such as streams, ponds, and lakes. Ground water flow is largely controlled by the hydraulic properties of the geologic strata, and occurs in response to hydraulic head differentials. However, manmade structures such as utility lines, ditches and culverts, roof drains, and paved surfaces can influence ground water flow. Ground water flows from areas of high potential energy (high hydraulic head) to areas of low potential energy (low hydraulic head). The regional and local ground water flow patterns are modified by local topography and surface water features, particularly streams and lakes.

Metamorphic rocks of the Inner Piedmont Geologic Province constitute the fractured bedrock and competent bedrock hydrogeologic units with ground water in the bedrock occurring under semi confined or artesian conditions. Water is stored in, and transmitted through fractures, bedding planes, joints, and cleavage planes. Recharge to the bedrock units occurs as leakage from the overlying saprolite. Ground water flow in the bedrock units is controlled by the distribution, interconnection, and concentration of fractures and other openings in the rock unit.

Generally, the fractured bedrock unit is the portion of the aquifer that is developed for water supply since the fractures extend out, effectively increasing the area available to receive recharge from the overlying saprolite.

Fractures are often unevenly distributed, but their orientations usually follow the regional stress orientation. In the North Carolina Piedmont, fractures tend to be oriented northeast-southwest with a perpendicular secondary set trending northwest-southeast. The size and numbers of fractures tend to decrease with increasing depth.

The ground water regime at the Site consists of the saprolite and underlying bedrock together forming a single ground water reservoir. Saprolite forms the uppermost hydrogeologic unit at the Site. Ground water occurs within the pore spaces of the saprolite under water table conditions. The base of the saprolite hydrogeologic unit coincides with the fractured bedrock surface at a depth ranging from 16 to 90 feet. The fractured bedrock hydrogeologic unit is in turn underlain by the competent bedrock hydrogeologic unit, which was encountered at 82 feet in W-8i and 80 feet in W-13i. Based on stream orientations and top of bedrock contouring, fracture zones which may influence bedrock ground water flow at the Site appear to have north-south and northwest-southeast orientations.

Groundwater at the Site occurs in an unconfined-to-semiconfined aquifer consisting of the overburden hydraulically interconnected with the underlying fractured bedrock. The saturated overburden serves as a groundwater reservoir which supplies water to the fractures, faults, and other secondary permeability features in the bedrock. The ground water surface in the vicinity of the OU 3 study areas occurs in the saprolite at depths ranging from approximately 4 feet above land surface in the artesian well W-29i to 45 feet below the land surface. Subsurface conditions encountered to date at the site are typical for the Piedmont Province.

Groundwater level measurements collected during the Operable Unit Three Remedial Investigation were used to determine shallow, intermediate, and bedrock groundwater gradients and flow directions on and around the textile property. The groundwater gradients indicate that groundwater in the shallow, intermediate, and bedrock portions of the aquifer appears to be flowing both to the north and to the south from the textile property.

The overburden ranges in thickness from 15-40 feet at the Site, and consists of saprolite and residual soils interspersed with unweathered gneiss/schist, and to a lesser extent, alluvium. Granitic intrusions are also common in the area of the Site. Soils in the general area of the Site belong to the Lloyd Association. These soils, located along broad ridges with short side slopes, are characterized as deep, well-drained soils with a subsoil of dark red clay.

E. Surface Water

On-site surface water drainage and flow patterns are generally controlled by topography and several man-made drainage structures constructed along West Front Street and Phoenix Street. The Site is gently sloping with elevations ranging from about 965 feet above mean sea level (msl) at a residential pond and intermittent stream located approximately 1,900 feet to the north of the Site.

The intermittent stream flows into a residential pond. The pond then discharges into Gregory Creek which is approximately 5,400 feet to the northeast. Another significant surface water feature to the north is a seep located approximately 50 feet north of the textile plant property line. The seep lies within the path of an intermittent stream which flows north from the textile plant property approximately 10 feet to the north of the property boundary. Surface runoff and storm water flow in the northern, eastern, and western portions of the study area are directed to the north via a series of culverts and site topography.

Surface water runoff and storm water flow in the southern part of the study area appear to be toward the south. Elevations south of the site decrease to about 895 msl at an intermittent stream located approximately 1,300 feet southeast of the site. The intermittent stream flows into Third Creek approximately 7,800 feet south of the site. Third Creek is defined as Class C fresh waters by NCDEHNR Water Quality Section. Surface waters within this area discharge to the South Yadkin River approximately 20 miles to the east. Intermittent streams lie to the north, northwest, and south of the site.

F. Meteorology

The climate in Iredell County is classified as fairly mild, and is influenced by the mountain ranges to the northeast, and the Atlantic Ocean to the southeast. Prevailing winds are from the southwest, although northeast winds do frequently occur in the autumn. Relative humidity averages about 70 percent throughout the year. Monthly total precipitation generally ranges from about 3 inches during October and November to about 5 inches during July and August.

G. Demography and Land Use

The Site is located along an industrial corridor which stretches along West Front Street. The area around the Site is characterized by a combination of light/heavy industry, commercial, residential, and institutional. The estimated population within the five-mile radius of the Site includes all of Statesville (18,622 in the 1980 census) and an estimated 9,500 living in Iredell County outside the city limits. The population within the three-mile radius of the Site includes about 90% of the city's population (about 17,000 people) and 2,440 county residents.

H. Utilities

Electricity, telephone, as well as water and sewage connections at the Burlington property exist and are available upon request.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Site History

The original textile plant was constructed in 1927 on the property presently owned by Burlington Industries. From 1955 to 1977, the plant was operated by Beaunit Mills, In 1967, Beaunit became a subsidiary of the El Paso Natural Gas Company. In April 1977, Beaunit sold substantially all of its assets, including the plant, to Beaunit II, Inc. As a part of the transaction, Beaunit changed its name to the Beaunit Corporation. In July 1978, the plant was sold by the Beaunit Corporation to Beaunit Fabrics Corporation. In 1981, Burlington Industries, Inc. purchased certain assets, including the plant, from Beaunit Fabrics. Burlington Industries operated the plant until its closure in May 1994.

B. Enforcement Activities

On June 25, 1993, EPA-Region IV signed an Administrative Order on Consent with Burlington Industries, as well as the former property owner El Paso Natural Gas Company, to conduct the Operable Unit Three Remedial Investigation and Feasibility Study (RI/FS) to investigate the contamination associated with the Burlington Industries property.

Pursuant to Section 113(K)(2)(B)(i-v) and Section 117 of CERCLA 42 U.S.C. § 9613 (k)(2)(B)(i-j), and 42 U.S.C. § 9617, the Community Relations Plan, as well as the RI/FS Reports and Risk Assessment for Operable Unit Three, were made available to the public in the Administrative Record. The Administrative Record is housed both in the Information Repository maintained at the EPA Docket Room in Region IV, and at the Iredell County Library in Statesville, North Carolina. Fact sheets were sent out in September 1995 updating local citizens about the Site. Fact sheets notifying local citizens about the availability of the RI/FS documents, explaining the RI/FS process, and summarizing site-related activities were sent out in July 1996. A notice of availability of these documents was also published in the Statesville Record and Landmark on July 18, 1996. A 30-day public comment period was held from July 18, 1996 to August 18, 1996. In addition, a public meeting was held on July 25, 1996 to inform citizens about EPA's preferred alternative for Operable Unit Three.

IV. SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

As with many Superfund sites, the FCX-Statesville Site is complex. For this reason, EPA currently believes that the remediation of the Site will be accomplished most effectively by implementing three phases of cleanup, referred to as "operable units".

Each operable unit requires a separate RI/FS, a separate Proposed Plan, and separate Record of Decision (ROD). The objectives of the three operable units (OUs) at the Site are:

OU One: Address the groundwater contamination emanating from the FCX property and migrating to the south of the FCX property.

OU Two: Address the soil contamination (mainly pesticides, polycyclic aromatic hydrocarbons (PAHs), pentachlorophenol, and dioxin) at the FCX property.

OU Three: Address all other contamination (mainly on-site soil and groundwater, and surface water/sediment in the seep area), associated with the textile property currently owned and operated by Burlington Industries.

The intent of the Operable Unit Three Remedial Action described in this ROD is to reduce the risk associated with the groundwater contamination at and around the Burlington Industries property, as well as to restore the groundwater aquifer to its beneficial use(s).

The Operable Unit Three Remedial Action will achieve these objectives by reducing the amount of volatile organic compounds in the on-site soil as a source of ground water contamination, and by treating the contaminated groundwater to meet all Federal MCLs or North Carolina Ground Water Standards, whichever are more protective. As a result, the quality of the surface water at the seep will be improved to meet State surface water standards.

V. SUMMARY OF REMEDIAL INVESTIGATION

The Remedial Investigation for Operable Unit Three was undertaken by the potentially responsible parties (PRPs), and the fieldwork conducted by their contractor, Aquaterra, Inc, Raleigh, North Carolina. The Remedial Investigation was conducted in three phases:

- Phase I included a soil gas survey, sampling/analyzing soil at specific areas, and sampling/analyzing surface water and sediment.

- Phase II included sampling/analyzing soil at specific areas, installing groundwater monitoring wells and sampling/analyzing groundwater, and collecting geologic/hydrogeologic information.

- Phase III included installing additional monitoring wells and sampling/analyzing groundwater, additional soil and groundwater sampling/analysis using the direct push technology, additional surface water sampling/analysis, and collecting additional hydrogeologic information.

During the Phase I, the soil gas survey consisted of removing vadose zone vapor from depths ranging from 2 to at least 15 feet below ground surface and analyzing the air using Level II methods for volatile organic compounds (VOCs) using a van mounted laboratory grade Hewlett-Packard Model 5890A gas chromatograph (GC) equipped with a flame ionization detector operated by Philip Environmental Services Corporation, formerly Burlington Environmental, Inc. The gas chromatograph allowed the determination of the particular substances present in the soil vapor. A total of 152 soil gas samples were collected from 66 locations on-site. See Figure 2. The results of the soil gas survey were used to select the locations that soil samples were to be collected at during Phase I and Phase II activities.

A. Soil Investigation

Based on the results of the soil gas survey, the size of the study areas was expanded during Phase I soil sampling. Figure 3 shows the soil sample locations. During June 1994, the RECON van, hand augers, and a drilling rig equipped with hollow stem augers and split spoons were used to collect soil samples in the saprolite. With the exception of the background soil sample location, where 2 samples were collected at 15 feet in depth, one soil sample was collected at each boring location in the upper 1 foot of soil with a second sample from up to at least 15 feet deep. During all Phase I soil sampling, (including soil samples collected with the RECON van, hand auger, and drilling rig equipped with hollow stem augers and split spoons), at least two samples per boring (one surface sample and one at highest TVA reading or at soil staining) were submitted for laboratory analysis.

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In order to characterize the analytes and potential source areas, one subsurface soil sample from each study area with the highest soil gas concentration of with visible staining was analyzed for the full target compound list (TCL)/target analyte list (TAL) parameters. Where allowed by access and building clearance a gridded pattern of locations surrounding the study areas was sampled and analyzed for TCL VOCs and SVOCs during Phase I. Including duplicates, a total of 82 soil samples were collected during Phase I soil sampling. After evaluation of the Phase I data, locations and depths for additional soil sampling were evaluated prior to initiating Phase II soil sampling activities.

The Phase II soil assessment was initiated upon completion of the soil gas survey and the receipt and review of the Phase I soil analytical results. The Phase II assessment was designed to characterize and define the vertical and horizontal extent of any analytes detected in Phase I. As part of the Phase II activities, soil samples were collected from each monitoring well location and analyzed for TCL volatiles. All other Phase II soil samples were analyzed for TCL SVOCs or TCL VOCs and SVOCs, because these were the parameters indicated to be of concern by the Phase I analytical results.

Phase II soil assessment activities utilized a hand auger and a drilling rig to collect soil samples at various sampling locations. These samples assisted in defining the source area(s) identified by Phase I analytical results and the concentration of analytes there. Soil borings were also placed in areas where the survey indicated trace or no concentrations of analytes to verify soil gas survey results. Soil samples were used to confirm that the extent of the impacts had been properly defined. A total of 75 soil samples were collected during Phase II soil sampling. During Phase III field activities, 11 soil samples were collected from 8 locations.

Soil Sample Results

A total of thirteen VOC compounds were detected in the 145 soil samples analyzed for VOCs. Based on analytical results and data validation for constituents in soil, the distribution of the compounds 1,2-Dichloroethane (DCE)(total), ethylbenzene, tetrachloroethane (PCE), toluene, Trichloroethane (TCE), and xylenes are thought to be representative of the distribution of VOCs in soils at the facility. Figure 4 shows PCE soil contamination in the soil horizon from 5-15 feet below land surface. The main areas with soil contaminated with PCE above 100 ppb include the Mop Pit Area, the Tank Area, the Rail Spur Area, the Dry Cleaning Area, and the Storm Drain Area. The highest levels of PCE were detected between the sewer line located west of the textile plant in the Storm Drain Area, and the northeastern portion of the Rail Spur Area. Significant areas of PCE contamination were also located in the northern portion of the Rail Spur Area, and west of the Dry Cleaning Area.

Ethylbenzene and xylene contamination in the soil was identified in the Mop Pit Area.

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Ethylbenzene and xylenes were also detected in soils located in the northern portion of the Rail Spur Area.

A total of 26 semi-volatile compounds were detected in the 125 soil samples analyzed for SVOCs. Based on comparison to analytical results from the PCU 1 Containment Area, comparison to background soil sample results, and data validation results, the following semi-volatile compounds were identified in soils at the textile facility:

2-methylnaphthalene	ace naphthene
acenaphthylene	anthracene
benzo(a)anthracene	benzo(a)pyrene
benzo(b)fluoranthene	benzo(g,h,i)perylene
benzo(k)fluoranthene	carbazole
chrysene	dibenz(a,h)anthracene
dibenzofuran	fluoranthene
fluorene	indeno(1,2,3-cd)pyrene
naphthalene	phenanthrene
pyrene	

These constituents are part of a group of compounds called polynuclear aromatic hydrocarbons (PAHs). In the top five feet of soil, the areas identified with PAH contamination above 100 micrograms per kilogram (ug/kg) include the west side of the Tank Area, along the sewer line in the Storm Drain Area on the west side of the textile facility, the northern portion of the Rail Spur Area, along the Railroad Line, and northwest of the Mop Pit Area. From 5 to 15 feet below the surface, the areas identified with PAH contamination in the soil included the PCU 2 Area, the Rail Spur Area, and the Tank Area.

Fifteen soil samples were analyzed for pesticide compounds during Phase I. The pesticide 4,4-DDT was detected at the Refuse Piles, at the southern boundary of the PCU 1 Area, and along the Railroad Line. The 4,4-DDT is not considered to be site-related, and was only detected at the southern boundary of the textile plant and off-site to the north of the textile facility. The polychlorinated biphenyl (PCB) Aroclor-1254 was detected at the Mop Pit Area and PCU 2 Area.

Fifteen soil samples were analyzed for inorganic constituents during Phase I. Following validation of the data, the results of the soils metals analysis were compared to values of two times the background concentrations. The inorganic constituents with maximum concentrations exceeding twice the background concentration included aluminum, arsenic, barium, calcium, cobalt, lead, magnesium, manganese, mercury, potassium, and zinc. Inorganic concentrations were highest at the sewer line west of the textile plant, at the USTs, at PCU 1, and near the Mop Pit.

B. Ground Water Investigation

The wells sampled and analyzed for TCL VOCs during the Phase I included W-1s through W-5s, MW-1 through MW-4, MW-5s, MW-5d, MW-6s, MW-6d, MW-7 through MW-11, and the Carnation supply well. Ground water elevations were also collected in all monitoring wells during Phase I. This initial information was necessary because ground water samples from wells W-1s through W-5s had only been analyzed once and additional ground water flow information was necessary prior to the installation of wells in Phase II.

During Phase II, 12 shallow wells and 11 intermediate-depth wells were installed and sampled across the textile plant and Carnation plant properties to investigate the extent of VOCs in ground water identified beneath the textile plant property. Figure 5 shows the well locations.

During Phase III, additional shallow, intermediate, deep wells were installed and sampled on an to the north of the textile facility to further characterize the VOC contamination in the ground water.

A Hydrocone sampling device was used during the Phase III field activities to collect ground water samples from the FCX property. The 6-foot sampling device was pushed to a depth ranging from 10 to 35 feet using a hydraulic system. These samples were analyzed for VOCs by Method 8240.

A Geoprobe ground water sampling device was also used during Phase II for collecting ground water samples at locations GP-1 through GP-6 to determine shallow ground water quality beneath the FCX building. The ground water samples were collected from a depth of approximately 35 feet below grade.

Installation and sampling of shallow and intermediate wells south of the FCX facility to continue VOC impact delineation and provide EPA with information regarding the Operable Unit One Remedial Design.

Groundwater Sample Results

A total of thirty-two volatile organic compounds were identified in 114 samples collected from 36 shallow wells, 6 Geoprobe locations, and 32 Hydrocone locations. The VOCs most commonly identified in the ground water during the Phase III included 1,1-DCA, 1,1-DCE, cis 1,2-DCE, PCE, toluene, 1,1,1-TCA, TCE, and vinyl chloride.

TCE contamination in the shallow ground water is migrating south from the vicinity of the Rail Spur Line, Mop Pit Area, PCU 2 Area, and PCU 1 Area. Figure 6 shows the TCE contamination

Extending from the general vicinity of the Rail Spur Line and the Dry Cleaning Area. 1,1-DCE contamination in the shallow ground water is migrating in a southerly direction from the general area of the Mop Pit.

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Five semivolatile organic compounds were identified in 23 samples from 19 shallow wells. Four semivolatile organic compounds were identified in 14 samples from 12 intermediate depth wells. Nine pesticide compounds were identified in 14 samples from 11 shallow wells. One pesticide compound was identified in samples from 3 intermediate depth wells. The pesticide heptachlor epoxide was detected in W-16i at 0.009JB ug/L.

A total of twenty-three volatile organic compounds, including carbon tetrachloride, chloroform, 1,1-DCA, cis 1,2-DCE, 1,1-DCE, PCE, toluene, 1,1,1-TCA, and TCE, were identified in 43 samples collected from 20 intermediate-depth wells. Figure 7 shows the PCE contamination extending northward from the Rail Spur Area, Dry Cleaning Area, and Storm Drain Area, and southward from the Mop Pit Area, PCU 2 Area, and PCU 1 Area. The VOCs cis-1,2-DCE, 1,2-dichloropropane, PCE, and TCE were also detected in the Carnation production well at the Carnation facility. Because of the industrial setting of the well, the source of the VOCs in the Carnation well is difficult to pinpoint.

The inorganic constituents identified in the ground water which exceeded twice the background metals concentrations were aluminum, arsenic, barium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, vanadium, and zinc. The highest concentrations were detected in wells MW-9, W-5s, W-6s, W-7s, W-16s, and W-17s. The elevated levels of inorganic constituents in the ground water during the Operable Unit Three Remedial Investigation may be caused by suspended solids and not dissolved inorganic constituents. The ground water velocity gradient in the immediate vicinity of a sampling well slotted screen may be great enough during the acquisition of a sample to cause local solids to become suspended in the moving ground water, where the suspended solids are transported into the sampling well, and ultimately into the collected sample. Once collected, that total metals analysis sample is immediately acidified with nitric acid to a pH of less than 2, which could then leach insoluble metals out of the suspended solids.

Aquaterra has tested this hypothesis by collecting ground water samples from wells W-5s, W-6s, W-7s, W-9s, W-16s, W-16i, and W-17s at the textile plant on June 27, 1996, and splitting the sample into two portions. The first portion was collected and preserved as a total metals analysis sample. The other portion of the sample was filtered through a 0.45 micron qualitative filter in the field prior to acidification and transport to the laboratory. The filtering step is not typically employed in the collection of ground water samples for inorganic analysis. The samples were analyzed for inorganics by SW-846 Methods.

In all cases the metals concentration in the filtered sample were substantially less than the unfiltered sample, many metals showed greater than two orders of magnitude reduction between the filtered and unfiltered samples. For example, the unfiltered concentration of aluminum from sampling well W-9 was reported as 36,100 ug/l, while the filtered sample reported aluminum concentration was 123 ug/l, a 99.66% reduction. All sampled wells showed significant reductions in metal concentrations between filtered and unfiltered samples, and in many cases the filtered metals concentration was below quantification limits (BQL).

The results of this test strongly support the conclusion that metals at the Site exist as suspended solids or colloids which are easily removed by filtration of the ground water. It is likely that in a ground water extraction well, fine suspended solids near the well would quickly be exhausted from the well and that after continuous pumping for a short period of time the metals concentrations would be reduced to concentrations similar to the filtered sample analytical results.

C. Surface Water/Sediment Investigation

The primary concern of the surface water/sediment investigation was to determine of ground water discharge or spills and overflows had resulted in migration of analytes to surface water bodies and sediment. The potential impact to the surface water bodies was evaluated during Phases I, II, and III of the RI. The sources of this information were primarily field data generated from the surface water/sediment sampling activities, laboratory analyses, ground water gradient maps of the site, and ground water analytical testing result for wells on the northern boundary of the textile plant.

During Phase I of the RI, surface water samples were collected at the pond, from the seep north of the textile plant, from the intermittent stream north of the seep, and from the drainage area northwest of the site. See Figure 8. The samples were collected as grab samples and analyzed for the full TCL/TAL parameters. The TCL/TAL parameters include substances that are consistent with textile operations and would indicate impact to surface water and sediments from the textile operations. In order to verify Phase I surface water data, one additional surface water grab sample was collected from the seep area during Phase II+ field activities and analyzed for TCL VOCs. Seven additional surface water samples were collected from the seep area and analyzed for TCL VOCs during Phase III field activities.

Surface Water/Sediment Sample Results

Fourteen surface water samples were collected from six stations representing a seep and surface water drainage north of the Site. Surface water samples SW-4, SW-5, SW-6, SW-7, SW-8, SW-9, SW-10, SW-11, and SW-12 were collected around the seep area, while samples SW-2 and SW-1 were collected along the creek to the north of the seep area. Sample SW-3 was collected from the stream to the west of the seep area. A total of thirteen different VOCs were identified in the fourteen samples. These VOCs include acetone, chloroform, 1,1,-DCA, 1,2-DCA, 1,1,-DCE, cis-1,2-DCE, trans-1,2-DCE, 1,2-dichloropropane, methylene chloride, PCE, TCE, toluene, and vinyl chloride.

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Based on the elevation of the seep area, the ground water table elevation, the flow direction in wells W-10s, W-7s, W-6s, and W-8s, and the similarity between the VOC concentrations in the ground water on-site and the VOCs at the seep, it appears that the seep is a ground water discharge point. While VOC concentrations measured at the seep are elevated, surface water samples collected to the north of the seep did not contain detectable levels of VOCs.

The semi-volatile compound (SVOC) bis(2-ethylhexyl) phthalate was detected in 4 of the 5 surface water samples at concentrations ranging from 1 to 2 ug/L. No pesticides were detected in the surface water samples. Five surface water samples were analyzed for inorganic constituents. The inorganic constituents that exceeded twice the background concentrations for surface water included barium, calcium, chromium, cobalt, iron, magnesium, manganese, nickel, potassium, sodium, vanadium, and zinc.

The VOCs 1,2-DCE (total), 1,2-dichloropropane, TCE, and vinyl chloride were detected in the sediment sample collected from the seep area. In addition, the compounds methylene chloride and toluene were also detected in the sediment collected at the pond. VOCs were not detected in sediment samples taken at the intermittent stream north of the seep, and the drainage area northwest of the site.

No SVOCs were detected in the sediment samples. However, of the 5 sediment samples analyzed, one Polycarbonated Biphenyl, Aroclor-1254, was detected in SED-1 collected where the stream enters the pond, at 350 ug/kg. Aroclor 1254 was also detected in the SED-1 duplicate sample at 220 ug/kg, and in SED-3 collected from the northwest drainage area at 37BJP ug/kg. The pesticide 4,4-DDT was detected in SED-2 at 2.1 J ug/kg.

The inorganic constituents identified in each of the 5 sediment samples included aluminum, arsenic, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium, and zinc. Calcium and zinc were the only inorganic constituents which exceeded twice the soil background concentrations.

D. Sludge Characterization

Sludge samples were collected from the PCU 1 Containment Area and the surge tank located in the sanitary sewer of the Storm Drain Area were analyzed for full TCL/TAL parameters. The only VOC identified in the sludge from the PCU 1 containment area at an elevated concentration was acetone at a concentration of 9.000 ug/kg. The SVOCs bis-2-ethylhexyl) phthalate and di-n-butyl phthalate were detected in the sludge at concentrations of 54,000 ug/kg and 60,000 ug/kg, respectively. The inorganic constituents detected in the sludge sample included aluminum, chromium, copper, iron, lead, manganese, nickel, thallium, and zinc.

Analysis of the sludge sample from the surge tank detected the VOCs chlorobenzene and PCE at 42,000 ug/kg and 4,900 ug/kg, respectively. SVOCs detected included 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-methylnaphthalene, bis(2-ethylhexyl) phthalate, and naphthalene. Aluminum, antimony, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, vanadium, and zinc were the inorganic constituents present in the sludge sample from the surge tank.

Overflow from the PCU-1 Containment Area potentially may have contributed SVOC analytes to the soil. The surge tank has not been demonstrated to have contributed analytes to the soil. Both the PCU-1 and surge tank contents will be removed and the areas decontaminated during the Remedial Action for Operable unit Three.

VI. SUMMARY OF SITE RISKS

The Baseline Risk Assessment Report presents the results of a comprehensive risk assessment that addresses the potential threats to public health and the environment posed by the Site under current and future conditions, assuming that no remedial actions take place, and that no restrictions are placed on future use of the Site. Actual or threatened releases from the Site, if not addressed, may present an imminent and substantial endangerment to public health, welfare, or the environment. The Baseline Risk Assessment evaluated the potential risk from exposure to contaminated groundwater, soil, surface water, and sediment associated with the property currently owned and operated by Burlington Industries. Contaminated soil and groundwater associated with the property currently owned and operated by Burlington Industries are the media of concern addressed in this Record of Decision as the Operable Unit Three Remedial Action. The Baseline Risk Assessment consists of the following sections: identification of chemicals of potential concern; exposure assessment; toxicity assessment; risk characterization; and remedial option goals. A separate evaluation of ecological risks was conducted. All sections except the uncertainty analysis and remedial goal options, are summarized below. Refer to the Baseline Risk Assessment for the uncertainty analysis and remedial option goals.

A. Chemicals of Potential Concern

In order to identify chemicals of potential concern for the Site, the chemicals present in Site samples were screened using comparisons with ambient or background concentrations, essential nutrient concentrations, as well as concentrations-toxicity criteria. If a chemical of potential concern was determined to contribute significantly to an unacceptable risk, and was not screened out using these comparisons, then it was considered to be a chemical of concern for the Site.

The chemicals of concern identified in the ground water during the Operable Unit Three RI include aluminum, arsenic, barium, iron, lead, manganese, bis(2-ethylhexyl)phthalate, carbon tetrachloride, chloroform, 1,1-DCE, cis 1,2-DCE, 1,2-Dichloropropane, methylene chloride, PCE, 1,1,2-TCA, TCE, and vinyl chloride. Several of these chemicals, such as the inorganics aluminum, arsenic, barium, iron, lead, and manganese, are not thought to be associated with former textile operations. Therefore, these inorganics will not be targeted for remediation during Operable Unit Three. Table 6-1 shows the contaminants of potential concern identified during the Operable Unit Three RI/FS with the exposure point concentrations. Chemicals were included in this discussion of the Site risk assessment indicated that a contaminant might pose a significant current of future risk, or contribute to a cumulative risk which is significant. On-site groundwater discharges into the seep to the north of the textile facility. In the surface water at the seep, concentrations of tetrachloroethane, iron, lead, and zinc exceeded federal chronic Ambient Water quality Criteria (AWQC). Tetrachloroethane and zinc also exceeded acute AWQC, and iron exceeded the North Carolina Fresh Surface Water Quality Standards (FSWQS). While these criteria were useful in selecting COPCs, their applicability is limited because they were not developed for use at a groundwater discharge point such as a seep. None of the COPCs except iron were found to present a potential ecological risk based on

TABLE 6-1
GROUND WATER CONTAMINANTS OF CONCERN

CHEMICALS	EXPOSURE POINT CONCENTRATIONS (ug/l)
Aluminum	34,100
Arsenic	9.1
Barium	292
Iron	260,000
Lead	71.1
Manganese	2,520
Bis(2-ethylhexyl)phthalate	67
Carbon Tetrachloride	68
Chloroform	44
1,1-Dichloroethane	73
cis 1,2-Dichloroethane	1000
1,2-Dichloropropane	24
Methylene Chloride	32
Tetrachloroethane	57000
1,1,2-Trichloroethane	11
Trichloroethane	480
Vinyl Chloride	1

B. Exposure Assessment

The exposure assessment evaluates and identifies complete pathways of exposure to human populations on or near the Site. Current exposure scenarios include the ingestion and dermal contact of soils, surface water, and sediment. Current land use assumptions include off-site residential and on-site child trespasser scenarios. Groundwater usage was not evaluated using the current land use assumptions because if has not been determined that the northward or southward-moving plumes have reached any private wells around the Site. Furthermore, the textile property is currently being used for industrial purposes, and the textile facility does not have a ground water drinking well in use.

Ground water usage was evaluated under the future land use scenario. Future exposure scenarios consider construction of water supply wells within the ground water contamination plume, as well as the incidental ingestion and dermal contact of soils, surface water, and sediment as reasonable maximum exposures. Exposure scenarios evaluate exposure to chemicals of concern from the ground water plume in drinking water and through inhalation of volatile organic compounds evolved from water in household use(s). Inhalation from showering was evaluated to account for doses of VOCs received from non-ingestion uses of water. The dose from inhalation of VOCs from showering was assumed to be equivalent to the ingestion of 2 liters of water. Once these contaminants of concern were identified, exposure concentrations in the ground water were estimated. The maximum concentrations detected were compared to the average of select samples in the contaminated area of the plume, and the lower of these values was chosen as the estimated exposure concentration. Table 6-2 shows the model used for calculating doses from the ingestion of contaminated ground water, including the exposure assumptions associated with ground water usage at the Site. Further detail and mathematical calculations can be viewed in the Final Baseline Risk Assessment, prepared by Philip Environmental in July 1996.

C. Toxicity Assessment

Under current EPA guidelines, the likelihood of adverse health effects occurring in humans from carcinogens and noncarcinogens are considered separately. These are discussed below. Table 6-3 summarizes the carcinogenic and noncarcinogenic toxicity criteria for the ground water contaminants of concern at the textile facility. Cancer sloper factors have been developed by EPA for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. Slope factors, which are expressed in units of (kg-day/mg), are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upperbound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upperbound" reflects the conservative estimate of the risks calculated from the slope factor. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

TABLE 6-2

MODEL FOR CALCULATING DOSES FROM
INGESTION OF GROUNDWATER

$$\underset{(mg/kg\text{-}day)}{\text{Groundwater Ingestion Dose}} = \frac{CW \times IR \times EF \times ED}{BW \times AT}$$

Where:

CW = Chemical concentration in groundwater (mg/L)
IR = Ingestion rate (L/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

Assumptions:

CW = Average concentration of select groundwater samples.
IR = 2 liters/day, for the adult resident.
EF = 350 days/year for the adult residents.
ED = 24 years for the adult resident.
BW = 70 kg for the adult resident.
AT = Exposure duration (years) x 365 days/year for evaluating noncancer risk.
= 70 years x 365 days/year for evaluating cancer risk.

TABLE 6-3

FCX STATESVILLE SITE,
OPERABLE UNIT THREE
TOXICITY CRITERIA

	Oral Slope Factor (mg/kg/day)-1	Ref.	Oral RfD (mg/kg/day)	Ref.
INORGANICS				
Aluminum		NTV	1.0E+0 1992	EPA,
Arsenic	1.5E+0 1992	IRIS,	3.0E-4 1993	IRIS,
Barium		NTV	7E-02 1992	IRIS,
Iron		NTV		NTV
Lead		NTV		NTV
Manganese		NTV	1.40E-01 1992	IRIS,
VOLATILE ORGANICS				
Vinyl Chloride	1.9E+0 1993	HEAST,		NTV
1,1-Dichloroethane	6.00E-01 1992	IRIS,	9.00E-03 1992	IRIS,
1,2-Dichloropropane	6.8E-02 1993	HEAST,		NTV

TABLE 6-3

FCX STATESVILLE SITE,
OPERABLE UNIT THREE
TOXICITY CRITERIA

	Oral Slope Factor (mg/kg/day)-1	Ref.	Oral RfD (mg/kg/day)	Ref.
Chloroform	6.10E-03	IRIS, 1992	1.00E-02	IRIS, 1992
1,1,2-Trichloroethane	5.7E-02	IRIS, 1992	4.0E-03	IRIS, 1992
Trichloroethene3	1.1E-2	Ref 3	6E-3	Ref3
Tetrachloroethane	5.2E-2	EPA, 1993	1.00E-02	IRIS, 1992
cis 1,2-DCE	NTV		1.0E-02	HEAST, 1993
Methylene Chloride	7.5E-03	IRIS, 1992	6.0E-02	IRIS, 1992
Carbon Tetrachloride	1.3E-01	IRIS, 1992	7.0E-04	IRIS, 1992

TABLE 6-3

FCX STATESVILLE SITE,
OPERABLE UNIT THREE
TOXICITY CRITERIA

	Oral Slope Factor (mg/kg/day)-1	Ref.	Oral RfD (mg/kg/day)	Ref.
SEMI-VOLATILE ORGANICS				
Bis(2-Ethylhexy)Phthalate	1.40E-02	IRIS, 1992	3.00E-02	IRIS 1992

1 Converted from a unit risk assuming the ingestion of 2 liters of drinking water per day and a body weight of 70kg (EPA, 1992)

2 Calculated from the current drinking water standard, assuming the consumption of 2 liters of water per day and a body weight of 70 kg.

3 Guidance from Superfund Technical Support Center.

NTV = No Toxicity Value

Dermal RfDs/SFs are derived

Absorption Factors (ABS):
0.2 - Inorganics
0.8 - Volatile Organics
0.5 - Semi-volatile Organics/Pesticides/PCBs

Dermal RfD = Oral RfD x ABS

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media can be compared to the RfD that are likely to be without risk of adverse effect. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied. These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

D. Risk Characterization

The risk characterization step of the risk assessment process integrates the toxicity and exposure assessments into quantitative and qualitative expressions of risk. The output of this process is a characterization of the Site-related, potential carcinogenic and noncarcinogenic health effects. Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ), or the ratio of the ingestion dose derived from the contaminant concentration in a given medium to the contaminant's Reference Dose (RfD).

To assess the overall potential for non-carcinogenic effects posed by more than one COPC, a hazard index ("HI") approach was used for each receptor scenario. The HI is equal to the sum of the HQs. When the total HI for a receptor exceeds unity (one), the approach utilized indicates that there may be concern for potential non-cancer health effects. This method assumes that the cumulative effect of multiple subthreshold exposures is additive, and may result in an adverse health effect to a particular target organ. HIs were calculated in a phased approach. Initially, all HQs were summed within each exposure scenario, and one HI was calculated for each receptor scenario. If the HI exceeded unity, COPCs then were grouped by target organ effect, and His were calculated for each target organ.

For carcinogens, risks are expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. These probabilities are generally expressed in scientific notation (e.g., 1X10-6 or 1E-6). An excess lifetime cancer risk of 1 X 10-6 indicates that, as a reasonable maximum estimate, an individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Carcinogenic risks for future hypothetical residents living on-site were determined from potential exposure due to the ingestion and inhalation of contaminated groundwater. The total carcinogenic risk due to the ingestion and inhalation of all volatile organic compounds present in on-site ground water by a future hypothetical resident is 7 x 10-3, or the risk that seven residents-out-of-one thousand residents would be at risk of developing cancer due to long-term exposure. With the exception of the hypothetical future on-site resident, all other current and future risks are within the Superfund Site risk range specified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), which is 10-4 to 10-6 (a potential excess cancer risk of one-in-10,000 to one-in-a-million).

Noncarcinogenic risk exceeded a Hazard Quotient (HQ) value of 1.0 for the future hypothetical on-site resident due to the ingestion and inhalation of contaminated ground water affecting the bloodstream. The HQ value for this future scenario is 1.2. Furthermore, the HQ value for the future on-site resident due to the ingestion and inhalation of contaminated ground water affecting the liver as the target organ is 37. With the exception of the hypothetical Site resident, all of these HIs are within the Superfund Site remediation goal specified in the NCP (an HI of less than 1.0).

E. Ecological Assessment

Surface water and sediment in the intermittent stream, and surface water and sediment at the seep, were considered the media of ecological concern at the Site due to the fact that potential receptors may experience direct contact with volatile organic compounds identified in the surface water and sediment. To assess surface water exposure, it was assumed that aquatic biota would experience continuous, prolonged exposure to the surface water ecological COPCs. To assess sediment exposure, it was assumed that aquatic biota would experience continuous, prolonged exposure to the sediment COPCs. Potential risks to environmental receptors at or near the Site were evaluated based on Site sampling data and a review of the toxicity of the chemicals of potential concern to ecological receptors.

Use of the Site by terrestrial receptors such as birds and small mammals, particularly the areas covered by the buildings and paved areas, was considered unlikely given the lack of trees or other vegetative cover on the textile facility. Based on a qualitative analysis, terrestrial wildlife communities in the upland and lowland areas around the textile facility are not likely to be significantly impacted. No threatened and endangered (T&E) or sensitive species of plants or animals were observed during the reconnaissance survey. This is consistent with U.S. Fish & Wildlife service and North Carolina Department of Environment, Health, and Natural Resources findings that few threatened or endangered species were know to occur within a 4-mile radius of the Site.

Due to the complete exposure pathways that may be present, surface water and sediment in the intermittent stream and seep north of the site were included as the aquatic media of ecological concern for OU-3. The highly conservative assumption that the intermittent stream and seep were conducive to support fish and aquatic invertebrates over a prolonged period of time, and amphibians were intermittently exposed, was used during this initial assessment. Due to the shallow depth in the seep and stream (typically only a few inches or less), it is unlikely that edible fish (by humans) and other fish are present in the stream.

The assessment endpoint for surface water was the health of aquatic biota. The measurement endpoint was health effects to aquatic biota, where data were available. The selected assessment endpoints for sediment were the health of aquatic biota based on potential metals toxicity and VOC toxicity. The measurement endpoint for VOCs was health effects to aquatic biota from bioavailable organic chemical stressors, based on an equilibrium-partitioning approach because direct toxicological information was not available.

In addition to direct exposure, possible impacts via food-chain effects were also considered. However, none of the VOCs or metals are of ecological concern due to bioaccumulation and subsequent food-chain effects. Therefore, no food-chain effect analysis was performed. No other media at the site provide significant complete pathways. The North Carolina Department of Environment, Health, and Natural Resources claims that few T&E species were known to occur within a 4-mile radius of the site.

Zinc concentrations in the eastern intermittent stream exceeded federal acute and chronic AWQC, but was below the background surface water concentration. Of the chemicals detected, only cis-1,2-dichloroethene was considered an ecological COPC because there are no screening values developed for it. The maximum chemical concentration for cis-1,2-DCE detected was below toxic effect levels obtained on AQUIRE. Also, all chemical concentrations downstream at the inlet to the pond north of the site were below background or screening values. Hence potential ecological impacts caused by site-related analytes in the intermittent stream surface water and pond should be insignificant.

In the seep water north of the site, concentrations of tetrachloroethane, iron, lead, and zinc exceeded federal chronic AWQC. Iron concentrations exceeded the North Carolina FSWQS, and zinc also exceeded federal acute AWQC. Of the analytes detected, 17 (7 VOCs and 10 inorganics) were considered ecological COPCs. Based on the potential aquatic receptors, only iron concentrations in seep water presented a potential ecological risk. However, it should be noted that these groundwater seep concentrations were compared to stream surface water background concentrations (not seep water background concentrations). If the concentrations of iron, lead, and zinc are compared to background groundwater concentrations, all chemicals are well below average background concentrations.

All of the other ecological COPCs in seep water were detected at concentrations which were below toxic effect levels obtained on AQUIRE. However, no toxicological information was available for 1,1-dichloroethane; therefore, no ecological impacts from this analyte could be ascertained. The lack of toxicological information and the relatively low maximum concentration (1.0 micrograms per liter [ug/L], detection limit 3 ug/L) suggest that ecological impacts are unlikely.

In the eastern intermittent stream, the concentration of zinc in surface water exceeded the federal AWQC. However, the maximum concentration was below the background screening level. Based on information gathered from the AQUIRE database, the COPC (cis-1,2-dichloroethene) was not found to present an ecological risk. In the stream sediment, the concentration of methylene chloride was not found to present an ecological risk based on information gathered from the AQUIRE database.

On-site ground water discharges to the seep north of the site. In the surface water at the seep, the concentrations of tetrachloroethane, iron, lead, and zinc exceeded federal chronic AWQC. Tetrachloroethane and zinc also exceeded acute AWQC, and iron exceeded North Carolina FSWQS. While these criteria were useful in selecting COPCs, their use and meaning are minimized because they were not developed for use at a seep. None of the COPCs except iron were found to present a potential ecological risk based on information gathered from the AQUIRE database and the types of aquatic organisms that may be exposed to seep water that is, at most, 2 in. deep, the iron concentration was found to present a potential ecological risk since the HQ = 5.26.

Once the surface water at the seep discharges into the stream, the concentration of iron in the stream surface water and in the sediment was below site background screening concentrations, and the concentration of iron in the seep sediment was below background screening concentrations. In seep sediment, none of the COPCs were found to present an ecological risk.

VII. Applicable or Relevant and Appropriate Requirements (ARARs)

The identification of ARARs is site-specific; since, each site has unique characteristics. ARARs as defined from the preamble to the final rule establishing the NCP (55 FR 8666) and the text of the regulations are:

"Applicable requirements means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable."

Substantive requirements generally involve a quantitation limitation or performance objective as opposed to administrative requirements such as record keeping and reporting. In addition, only standards or requirements that have been promulgated before the record of decision (ROD) is signed are applicable for the compounds identified prior to the ROD.

"Relevant and appropriate requirements means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmentally or facility siting laws that, while not `applicable' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate."

If a regulation or a portion of a regulation is identified as relevant and appropriate, it is applied just as strictly as an "applicable" requirement. As with applicable requirements, only substantive requirements promulgated before the ROD is signed can be relevant and appropriate.

"First to determine relevance a comparison is made between the action, location, or chemicals covered by the requirement and related conditions of the site, release, or remedy; a requirement is relevant if the requirement generally pertains to these conditions. Second to determine whether the requirement is appropriate, the comparison is further refined by focusing on the nature of the substances, the characteristics of the site, the circumstances of the release, and the proposed remedial action; the requirement is appropriate if, based on such comparison, its use is well-suited to the particular site. Only those requirements that are determined to be both relevant and appropriate must be complied with." (53 FR 51436)

ARARs are classified into three general groups:

- Chemical-specific ARARs: Health or risk-based concentration limits or ranges in various environmental media for specific hazardous substance, pollutants, or contaminants. These limits may take the form of action levels or discharge levels.

- Location-specific ARARs: Restrictions on activities that are based on the characteristics of a site or its immediate environment. An example would be restrictions on wetlands development.

- Action-specific ARARs: Controls or restrictions on particular types of activities such as hazardous waste management or wastewater treatment. An example would be RCRA incineration standards. Such requirements are triggered by the particular remedial action selected.

Federal ARARs are summarized in Table 7-1 and North Carolina ARARs are summarized in Table 7-2.

TABLE 7-1

ANALYSIS OF FEDERAL ARARs

Standard, Requirement, Criteria, or Limitation	Regulatory Citation	Description	Potential ARAR	Justification Comments
Resource Conservation and Recovery Act				
Location-Specific ARARs under RCRA				
Seismic considerations	40 CFR 264.18(a)	Restricts location of TSD facilities within 200 ft of a fault that has had a displacement within Holocene time.	No	No known faults within or in the vicinity of the Site.
Floodplains	40 CFR 264.18(b)	Requires TSD facility located within a 100-year flood plain to be designed, constructed, operated, and maintained to prevent washout of any hazardous wastes by a 100-year flood.	No	The Site or the remedial actions are not located in the 100-year flood plain.

TABLE 7-1

ANALYSIS OF FEDERAL ARARs

Action-Specific ARARs under RCRA

Requirements for hazardous waste generators	40 CFR Part 262.11	Establishes standards for generators of hazardous wastes.	Yes	Potentially applicable to remedial actions involving removal of hazardous waste (e.g., spent carbon from carbon adsorption process).
Requirements for transporters of hazardous waste	40 CFR Part 263	Establishes standards which apply to transporters of hazardous waste within the United States if the transportation requires a manifest under 40 CFR Part 262.	Yes	Potentially applicable to remedial actions involving transportation of hazardous waste from the Site to disposal facility
Requirements for owners and operators of hazardous waste treatment, storage, and disposal (TSD) facilities	40 CFR Part 264.601 40 CFR 265.400	Establishes minimum national standards which define the acceptable management of hazardous wastes for owners and operators of facilities which treat, store, or dispose of hazardous wastes.	Yes	Potentially applicable to remedial actions involving treatment, storage, and disposal of hazardous waste.
Land Disposal Restrictions	40 CFR Part 268	Identifies hazardous wastes that are restricted from land disposal	Yes	Potentially applicable to remedial actions involving removal of hazardous wastes (e.g., spent carbon from carbon adsorption process.)

TABLE 7-1

ANALYSIS OF FEDERAL ARARs

Clean Water Act (CWA)	33 USC 1251-1367			
Action-Specific ARARs				
National Pollutant Discharge Elimination System (NPDES) requirements	CWA Part 402 40 CFR Part 125	Requires permit for effluent discharge from any point source into surface waters of the United States.	Yes	Potentially applicable to remedial actions involving discharges to surface waters.
Effluent guidelines and standards for the point source category	40 CFR Part 401	Requires specific effluent characteristics for discharge through NPDES system.	No	No categorical standards established for hazardous waste sites.
National pretreatment standard for indirect discharge to a POTW	CWA Part 307(b) 40 CFR Part 403	Establishes standards to control pollutants which pass through or interfere with treatment processes in public treatment works which may contaminate sewage sludge.	Yes	Potentially applicable to current discharge of groundwater into local POTWs.
Technology-based effluent limitations	CWA Part 301(b)	Establishes guidelines to determine effluent standards based on the Best Available Technology (BAT) economically achievable.	Yes	Potentially applicable to groundwater remediation.
Clean Air Act		42 USC 1857-18571		

TABLE 7-1

ANALYSIS OF FEDERAL ARARs

National Ambient Air Quality Standards (NAAQS)	40 CFR 50	Establishes ambient air quality standards for classes of pollutants.	No	Only "major sources" (emissions exceeding 100-250 tons per year of regulated pollutants).
National Emission Standards for Hazardous Air Pollutants (NESHAP)	40 CFR 61	Stipulates monitoring requirements for emissions of specific contaminants.	No	
Safe Drinking Water Act (SDWA)	42 USC 300			
Chemical-Specific ARARs				
National Primary Drinking Water Standards	40 CFR Part 141	Establishes health-based enforceable standards for public water systems (maximum supply. contaminant levels (MCLs).	Yes	Future potential use of groundwater as potable water contaminant levels (MCLs)). supply.

TABLE 7-1

ANALYSIS OF FEDERAL ARARs

National Secondary Drinking Water Standards	40 CFR Part 143	Establishes aesthetic-based, non-enforceable guidelines for public water systems (secondary maximum contaminant levels (SMCLs)).	Yes	Future potential use of groundwater as a potable water supply.
Maximum Contaminant Level Goals	40 CFR Part 141	Establishes non-enforceable drinking water quality goals (MCLGs) set at levels that cause no known or anticipated adverse health effects with an adequate margin of safety without consideration of available treatment technology or cost.	Yes	Future potential use of groundwater as a potable water supply.
Clean Water Act	42 USC 1857-18571			
Toxic Pollutant Effluent Standards	40 CFR 129	Establishes effluent standards or prohibitions for certain toxic pollutants: aldrin/dieldrin, DDT, endrin, toxaphene, benzidine, PCBs	No	These pollutants have not been identified as chemicals of concern at the Site.
Point Sources	40 CFR 400	Establishes pretreatment concentrations	Yes	Potential for any POTW discharge.
Resource Conservation and Recovery Act	42 USC 6901			

TABLE 7-1

ANALYSIS OF FEDERAL ARARs

Identification and Listing of hazardous Waste	40 CFR 261 Subparts C and D	Defines those solid wastes that are subject to and regulated as hazardous wastes under 40 CFR 262-270.	Yes	Potentially applicable to remedial actions involving solid waste removal in the identification of wastes and application of other action-specific ARARs.
RCRA Maximum Concentration	40 CFR 264.94	Standards for 14 hazardous constituents as a part of RCRA ground water protection standards.	Yes	For RCRA permitted facilities Limits with regulated waste untis.
Treatment Standards	40 CFR 268 Subpart D	Treatment standards for hazardous wastes or hazardous waste extracts before land disposal is allowed.	Yes	See above.
Action-Specific ARARs				
Underground Injection Control (UIC) Regulations	40 CFR Parts 144-147	Provides for protection of underground sources of drinking water.	Yes	Potentially applicable to groundwater remediation if injection of treated groundwater is selected as a discharge technology.

TABLE 7-1

ANALYSIS OF FEDERAL ARARs

Clean Air Act (CAA)	40 USC 1957			
Chemical-Specific ARARs				
National Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Establishes ambient air quality standards for classes of pollutants - carbon monoxide, hydrocarbons, lead, nitrogen dioxide, particulate matter, ozone, and sulfur oxides. Standards of not apply directly to source-specific emissions, but are ambient concentration limitations.	No	Only "major sources" (emissions exceeding 100-250 tons per year of regulated pollutants) are subject to NAAQS attainment requirements.
National Emission Standards of Hazardous Air Pollutants (NESHAP)	40 CFR Part 61	Establishes emission standards for seven contaminants - benzene, mercury, arsenic, asbestos, beryllium, vinyl chloride, and radionuclides.	No	Not applicable to the Site as benzene and vinyl chloride are not contaminants of concern at the Site.

TABLE 7-1

ANALYSIS OF FEDERAL ARARs

Occupational Safety and Health Administration				
Chemical-Specific ARARs				
Safety of workers	29 USC 651-678	Regulates workers' health and safety.	Yes	Applicable to remedial actions at the Site.
Department of Transportation (DOT) Hazardous Materials Transportation Act				
Action-Specific ARARs				
Hazardous Materials Transportation Regulations	49 USC 1801-1813 49 CFR 107 Sections 171-177	Regulates transportation of Department to Transportation (DOT)-defined hazardous materials.	Yes	Potentially applicable to any remedial action involving transportation of DOT-defined hazardous materials off-site.

TABLE 7-1

ANALYSIS OF FEDERAL ARARs

Regulations Protecting Landmarks, Historical, and Archaeological Sites

Location-Specific ARARs

National natural landmarks	Historic Sites Act of 1935, 16 USC 461, 40 CFR 6.301(a)	Establishes regulations to protect national natural landmarks during remedial actions.	No	Site is not located in an area with natural landmarks.
Historic, architectural, archaeological, and cultural sites	National Historic Preservation Act of 1966, 16 USC 470, 36 CFR 800, Executive order 11593 40 CFR 6.301(b)	Establishes regulations to protect historic, architectural, archaeological, and cultural sites during remedial actions.	No	Site is not located in an area with historic, architectural, archaeological or cultural sites.
Historic, rehistoric and archaeological data	Archaeological Preservation Act of 1974, 16 USC 469 et seq. Executive Order 11593 O CFR 6.301	Establishes regulations to protect historic, prehistoric, and archaeological data during remedial actions.	No	Site is not located in an area with prehistoric or archaeological data.

TABLE 7-1

ANALYSIS OF FEDERAL ARARs

Endangered Species Act

Action-Specific ARARs

Protection of endangered species	16 USC 1531, 50 CFR Part 200,50 CFR Part 402	Requires action to conserve endangered species and/or critical habitats upon which endangered species depend.	Yes	Potentially applicable as endangered and threatened species have been identified in the Onslow County.
Clean Water Act Dredge or Fill Requirements	33 USC 40 CFR 230, 231	Requires permits for discharge of dredged or fill material into navigable waters as part of any alternative.	No	There will be no discharge of dredged or fill material into navigable waters
Wilderness Act	16 USC 1131 50 CFR 35.1	Administers federally owned wilderness area to leave in unimpacted.	No	No wilderness area is situated on-site or adjacent to the Site
National Wildlife Refuge Act	16 USC 668 60 CFR 27	Restricts activities within a National Wildlife Refuge	No	No wildlife refuge areas are located on-site or adjacent to the Site
Scenic River Act	16 USC 1271 40 CFR 6.302(e)	Prohibits adverse effects on scenic rivers	No	No scenic rivers are located in the area adjoining the Site.
Coastal Zone Management Act	16 USC 1451	Conduct activities in accordance with site-approved management program	No	Site is not in a coastal zone.

TABLE 7-1

ANALYSIS OF FEDERAL ARARs

Regulations to Protect Wetlands	33 CFR Section 323	Requires consideration of the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practical alternative exists.	Yes	Portion of the Site may be in a wetland. Area may be less than 1/3 acre, which is a threshold value.
Fish and Wildlife Coordination Act				
Action-Specific ARARs				
Protection of fish and wildlife due to any modifications of water bodies.	16 USC 661-666	Requires adequate provision for protection of fish and wildlife resources when any modification of any stream or other water body is proposed.	Yes	Potentially applicable if the remedial action involves discharge of treated water to Third Creek.

TABLE 7-2

Analysis of State of North Caroline ARARs

Chemical-Specific ARARs

Identification and Listing of hazardous waste	15 A NCAC 13 A.0006	Defines those solid wastes which are subject to state regulation and as a hazardous waste. Consistent with corresponding federal standards (characteristic and listed hazardous waste designations).	Yes	Potentially applicable to remedial actions involving solid waste removal.

North Carolina Water and Air Resources Act

Action-Specific ARARs

Laws to achieve and to maintain a total environment with superior quality.	General Statues, Chapter 142 Article 21B	State equivalent of the Federal CWA and CAA	Yes	Potentially applicable for remedial action involving cleanup of groundwater and emissions to the atmosphere.

TABLE 7-2

Analysis of State of North Caroline ARARs

North Carolina Drinking Water Act

Action-Specific ARARs

Regulations on drinking water	General Statues Chapter 130A Article 10	Establishes criteria for protection of state public water supplies.	Yes	Current limited use and potential future use of groundwater as a potable water supply.

North Carolina Water Pollution Control Regulations

Action-Specific ARARs

Requirements for wastewater discharge to surface water	NCAC Title 15 Chapter 2, Subchapter 2H	Requires permit for discharge of effluent from point sources into surface waters. State-level version of federal NPDES program.	Yes	Potentially applicable to remedial actions involving point source discharges to surface waters.
Wastewater Treatment Requirements	NCAC Title, 15, Chapter 2, Subchapter	Establishes basic wastewater treatment requirements for effluent discharge.	Yes	Potentially applicable to remedial actions involving point source discharges.

TABLE 7-2

Analysis of State of North Caroline ARARs

North Carolina Drinking Water and Groundwater Standards

Chemical-Specific ARARs

Groundwater Classifications and Standards	NCAC Title 15, Chapter 2, Subchapter 2L Sections .0200nd 0.0201	Establishes groundwater and drinking water standards based on the usage.	Yes	Potentially applicable to groundwater remediation based on anticipated future usage.

North Carolina Surface Water Quality Standards

Chemical-Specific ARARs

Classification and water quality standards applicable to surface water	NCAC Title 15A, Subchapter 2B, Sections .0100 and .0200	Establishes a series of classifications and water quality standards for surface waters.	Yes	Potentially applicable to surface water and to discharge of treated groundwater to a surface water body.
Technology-based effluent limitations	NCAC Title 15A, Subchapter 2B Section .0400	Establishes guidelines for effluent limitations based on BAT economically achievable.	Yes	Potentially applicable to surface water and groundwater treatment.
North Carolina Ambient Air Quality Control Act	Title 15A NCAC Subchapter 2D, 2H			

Chemical/Action-Specific ARARs

TABLE 7-2

Analysis of State of North Caroline ARARs

Ambient Air Quality Standards	Subchapter 2D Section .0400	Establishes ambient air quality standards and methods for sulfur dioxide, total suspended particulates, PM10, carbon monixide, ozone, nitrogen dioxide, etc.	Yes	Potentially applicable if air emissions are involved in soil or ground water treatment technology.
Chemical/Action-Specific ARARs				
Regulations dealing with stripping operations	NCAC Title 15 A, Chapter 2, Subchapter 2D Section .0600, Subchapter 2H Section .1000	NCDEHNR is in the process of promulgating regulations dealing with air stripping operations. These regulations, when promulgated, may subject air stripping operations to toxic regulations. Currently, registration of air strippers is required.	Yes	Potentially applicable if air stripping is used as a treatment technology.

Under CERCLA, if a standard or requirement from state or federal environmental or public health laws can reasonable be applied to a site cleanup or the development and evaluation of remedial actions, that standard should establish the cleanup level. In accordance with the NCP requirements under CERCLA, the selected remedial action must meet all ARARs unless a waiver from a specific ARAR is granted by EPA or the state of North Carolina. Typically waivers have been granted for one or more of the following situations:

- When interim measures are being considered or implemented, and will be followed by a permanent or final remedial action that meets all ARARs.

- When compliance with an ARAR would create greater threat to public health or the environment than other options.

- When compliance with the ARAR is technically impractical.

- When a different or alternate method can meet the standard for an ARAR that specifies a particular design or operating standard.

- When a more stringent state standard has not been applied consistently throughout the state, the state standard may be waived.

- For EPA-lead CERCLA-funded cleanups, ARARs may be waived if their cost compared to the degree of protection or risk reduction greatly reduce the availability of funds for other sites.

VIII. REMEDIAL ACTION OBJECTIVES

Based on the results of the Operable Unit Three RI/FS and Baseline Risk Assessment, the textile facility is comprised of several contaminated media. The Remedial Investigation indicates that on-site soil is contaminated with inorganics, PAHs, and most notable VOCs. The second medium consists of groundwater contaminated primarily with VOCs. Surface water and sediment at the seepintermittenttant stream to the north of the textile facility also reveal some contamination with inorganics, PCBs, and VOCs.

A. Soil Contamination

The analytical results of the Operable Unit Three Remedial Investigation indicate that elevated levels of several contaminants, mainly volatile organic compounds, are present at elevated levels in the shallow and intermediate depth soil at the textile facility. No cleanup levels have been established for on-site contaminated soil; however, the objective of a soil remedial action would be to minimize the potential for infiltration of VOCs from the soil into the ground water.

B. Groundwater Contamination

The vertical extent of VOC groundwater contamination has been identified in the shallow and intermediate portions of the aquifer, and is assumed to extend into the fractured bedrock portion of the aquifer. The extent to which each of the VOCs has migrated from the source areas depends on a number of factors, including the location and depth of the source area(s), and the physical properties affecting the flow and transport of each compound (i.e., density, solubility, viscosity, and surface tension). Table 8-1 contains the groundwater remediation levels, or the chemical-specific ARARs for the groundwater contaminants of concern.

IX. DESCRIPTION OF ALTERNATIVES

ALTERNATIVES TO ADDRESS GROUNDWATER CONTAMINATION

The following section describes the technologies considered for remediating the groundwater associated with the textile facility. The section also provides the rationale as to why certain technologies were not retained for further consideration after the initial screening. The following alternatives were evaluated to address groundwater contamination.

Alternative GA-1:No Action

CERCLA requires that the No Action Alternative be evaluated at every site to establish a baseline for comparison. Under this alternative, no further action would be taken at the Site to remove or treat groundwater contamination. A review of the remedy would be conducted every five years in accordance with the requirements of CERCLA. Five-year reviews would be conducted for a period of 30 years; the total present worth costs of the five-year reviews $55,240.

Alternative GA-2:Limited Action

This alternative, like the No Action Alternative, would not involve actual remediation of contaminated groundwater. This alternative would utilize deed restrictions to restrict access to contaminated groundwater on-site. This alternative would also require the long-term monitoring of Site groundwater based upon 30 years of monitoring. Sampling and analysis of groundwater would be conducted semiannually for a period of 30 years. The total present worth cost of Alternative GA-2, including establishing deed restrictions, monitoring the ground water for 30 years, and conducting 5-year reviews for a 30-year period, is estimated to be $2,826,940.

Alternative GA-3:Air Sparging with Passive Venting

Air sparging is an in-situ remedial technology where air is introduced into the aquifer under pressure through a number of wells, thereby causing the organic compounds in the groundwater to volatilize. Alternative GA-3 would permanently reduce the amount of VOCs in the groundwater. Passive venting means that no vacuum would be applied to the wells to actively remove the volatilized compounds from the wells. Therefore, once the organic compounds have volatilized, the vapors would discharge from the wells into the atmosphere. However, modeling would be conducted during the Remedial Design to ensure that the North Carolina Air Emission Standards would not be violated utilizing the passive venting. The total present worth costs for Alternative GA-3 are estimated to be $2,944,700.

TABLE 8-1
GROUNDWATER REMEDIATION LEVELS (ug/l)

CHEMICALS	REMEDIATION LEVELS (UG/L)
Aluminum	50-200 (l)
Arsenic	50 (2)
Barium	2000 (2)
Iron	300 (2)
Lead	15 (3)
Manganese	50 (2)
Bis(2-ethylhexyl)phthalate	3 (2)
Carbon Tetrachloride	.3 (2)
Chloroform	.19 (2)
1,1-DCE	7 (2,3)
cis 1,2-DCE	70 (2,3)
1,2-Dichloropropane	.5 (3)
Methylene Chloride	5 (3)
Tetrachloroethane (PCE)	.7 (2)
1,1,2-Trichloroethane	5 (3)
Trichloroethane	2.8 (2)
Vinyl Chloride	.015 (2)

(1) National Secondary Drinking Water Standards
(2) North Carolina Ground Water Quality Standards (NCGWQS) NCAC 2L.0202
(3) Maximum Contaminant Levels (MCLs)

Alternative GA-4:Air Sparging with Active Venting

Air sparging is an in-situ remedial technology where air is introduced into the aquifer under pressure through a number of wells, thereby causing the organic compounds in the groundwater to volatilize. Alternative GA-4 would permanently reduce the amount of VOCs in the groundwater on-site. Active venting means that positive vacuum would be applied to the wells to help induce the volatilization of the organic compounds, as well as actively remove the volatilized compounds from the wells. However, modeling would be conducted during the Remedial Design to ensure that the North Carolina Air Emission Standards would not be violated utilizing the active venting. The total present worth costs for Alternative GA-4 are estimated to be $3,030,200.

Alternative GA-5:Groundwater Extraction and Treatment by Chemical Precipitation and Carbon Adsorption

This alternative would involve installing eight shallow and one deep bedrock recovery well for the recovery and treatment of contaminated groundwater. A piping system would also be installed to transport the groundwater from the wells to a holding tank and the treatment system. Precipitation/filtration and carbon adsorption would be used to treat contaminated groundwater for all site-related contaminants of concern. The treated groundwater would then be discharged to either a nearby drainage ditch or to the publicly-owned treatment works. Long-term monitoring of the groundwater around the site would be implemented. Institutional controls such as deed restrictions would also be implemented. The total present worth costs for Alternative GA-5 are estimated to be $8,451,560.

Alternative GA-6:Groundwater Extraction and Treatment with Chemical Precipitation, Air Stripping, and Carbon Adsorption

This alternative would include all of the components of Alternative GA-5, plus a low-profile tray-aeration air stripper. The carbon vessels used in this alternative would be smaller than those used in Alternative GA-5. The total present worth costs for Alternative GA-6 is estimated to be $7,288,710.

ALTERNATIVES TO ADDRESS SOIL CONTAMINATION

The following section describes the technologies considered for remediating the soil contamination associated with the textile facility. The section also provides the rationale as to why certain technologies were not retained for further consideration after the initial screening.

Alternative SA-1:No Action

By law, EPA is required to evaluate a No Action Alternative to serve as a basis against which other alternatives can be compared. No remedial action would be implemented under the No Action Alternative. Contaminated soil would be left in place as a source of groundwater contamination. Any reduction in contaminant concentrations in the soil would result from natural dispersion, attenuation, and degradation processes. The present worth cost for Alternative SA-1 is estimated to be $0.

Alternative SA-2:Limited Action

As with the No Action Alternative SA-1, no active remedial action would be conducted under the Limited Action Alternative SA-2. The existing buildings and paved areas would be left intact. The property deed would be amended to prohibit future uses of the site that would uncover or expose contaminated soil beneath the buildings and paved areas. The deed restrictions would also specify that the property is only to be used for commercial and industrial purposes, and is not suitable for residential or recreational purposes. Groundwater monitoring would be conducted semi-annually for 30 years. The total present worth costs for Alternative SA-2 is estimated to be $5,000.

Alternative SA-3:Capping

Capping the area(s) consists of covering an area with Low-permeability materials. As a result, the infiltration of precipitation and surface water is reduced and the leaching of soil contaminants is limited. Most of the textile facility is already covered by low permeability materials such as buildings, concrete, and asphalt. Emplacement of new capping materials would be considered in the event that soil contamination is discovered that has the potential for threatening the ground water quality in an uncapped area of the textile facility. The total present worth costs for Alternative SA-3 is estimated to be $12,500,000.

Alternative SA-4:Excavation and Off-site Disposal

Excavation requires the physical removal of contaminated soils from the textile facility, and disposing of the soils in an appropriate manner in compliance with Federal, state, and local regulations. This process could be used in conjunction with an ex-situ remedial alternative whereby the cleaned soil would be returned to the excavated areas, or a soil removal whereby the excavated soils would be evaluated for waste characterization and disposed of at a properly permitted facility. If off-site disposal were used, the excavated areas would be backfilled with clean fill material from an off-site source. Due to the extremely large volume of contaminated soil on the textile facility, the total present worth costs for Alternative GA-4 is estimated to be $115,000,000.

Alternative SA-5:Soil Vapor Extraction

Soil Vapor Extraction (SEE) is an established technology for in-place soil treatment. It is primarily applicable to treatment of VOC-contaminated soils. SEE treatment removes VOCs from the soil by mechanically drawing air through the soil pore spaces. VOCs volatilize as the air moves through the soil. The VOC-laden air is then collected and discharged or is subjected to further treatment, depending on the amount and types of contaminants present.

SEE is accomplished by installation of an array of vapor extraction wells in the contaminated portion of the unsaturated (vades) zone. The wells are manifolded to the suction side of air blowers (vacuum pumps), creating a negative pressure in the wells and piping to draw air from the soil. Each well is valved and can be adjusted to the desired air flow rate. Using these valves, a SEE system has the flexibility to withdraw air from the most contaminated areas (thereby maximizing the mass removal rate) or to operate at a lower mass emission rate as may be required by the emissions treatment system. The total present worth costs for Alternative GA-4 is estimated to be $1,076,920.

X. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The remedial alternatives to address soil and groundwater contamination of the textile facility using the none evaluation criteria as set forth in the NCP, 40 CFR 300,430(e)(9). A brief description of each of the nine evaluation criteria is provided below.

THRESHOLD CRITERIA

1. Overall Protection of Human Health and the Environment addresses how an alternative as a whole will protect human health and the environment. This includes an assessment of how the public health and the environment risks are properly eliminated, reduced, or controlled through the treatment, engineering controls, or controls placed on the property to restrict access and (future) development. Deed restrictions are examples of controls to restrict development.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) addresses whether or not a remedy complies with all state and federal environmental and public health laws and requirements that apply or are relevant and appropriate to the conditions and cleanup options at a specific site. If an ARAR cannot be met, the analysis of the alternative must provide the grounds for invoking a statutory waiver.

PRIMARY BALANCING CRITERIA

3. Long-term Effectiveness and Permanence refers to the ability of an alternative to maintain reliable protection of human health and the environment over time once the cleanup levels have been met.

4. Reduction of Toxicity, Mobility, or Volume are the three principal measures of the overall performance of an alternative.

The 1986 amendments to the Superfund emphasize that, whenever possible, EPA should select a remedy that uses a treatment process to permanently reduce the level of toxicity of contaminants at the site; the spread of contaminants away from the source of contaminants; and the volume, or amount, of contamination at the site.

5. Short-term Effectiveness refers to the likelihood of adverse impacts on human health or the environment that may be posed during the construction and implementation of an alternative until cleanup levels are achieved.

6. Implementability refers to the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement the alternative.

7. Cost includes the capital (up-front) cost of implementing an alternative, as well as the cost of operating and maintaining the alternative over the long-term, and the net present worth of both the capital and operation and maintenance costs.

MODIFYING CRITERIA

8. State Acceptance addresses whether, based on its review of the RI/FS and Proposed Plan, the State concurs with, opposes, or has no comments on the alternative EPA is proposing as the remedy for the Site. The State's concurrence letter is attached as Appendix A.

9. Community Acceptance addresses whether the public concurs with EPA's Proposed Plan. Community acceptance of the Proposed Plan were be evaluated based on verbal comments received at the public meetings and those written comments received during the public comment period.

These evaluation criteria relate directly to requirements in Section 121 of CERCLA, 42 U.S.C. § 9621, which determine the feasibility and acceptability of the remedy. Threshold criteria must be satisfied in order for a remedy to be eligible for selection. Primary balancing criteria are used to weigh major trade-offs between remedies. State and community acceptance are modifying criteria formally taken into account after public comment is received on the Proposed Plan. Once the potential remedial alternatives to address soil and groundwater were developed and screened, each alternative was subjected to detailed comparative analysis.

COMPARATIVE ANALYSIS OF GROUND WATER AND SOIL ALTERNATIVES

Threshold Criteria

Overall Protection of Human Health and the Environment

Each alternative was evaluated to determine whether it is likely to effectively mitigate and minimize the long-term risk of harm to public health and the environment currently presented at the Site. Alternatives GA-1 would not be effective in protecting human health and the environment, while GA-2 would be somewhat protective as long as the deed restrictions were implemented effectively. Alternatives GA-3, Ga-4, GA-5, and GA-6 would all be protective of human health and the environment by reducing levels of all site-related contaminants to meet all State and federal requirements.

Compliance with ARARs

Alternatives GA-1 and GA-2 would not reduce contaminant levels; therefore, they would not meet the State Standards and Federal MCLs. EPA believes Alternatives GA-3, GA-4, GA-5 and GA-6 would reduce contaminant levels to meet all State and Federal ARARs.

Primary Balancing Criteria

Short-term Effectiveness

Alternatives 1 and 2 would not reduce the site-related contamination on a short-term basis.

restrictions would be placed on future land use at the Site; therefore, Alternative GA-1 would not eliminate any exposure pathways or reduce the level of risk. Deed restrictions implemented under Alternatives GA-2, GA-3, GA-4, GA-5, or GA-6 would provide protection to nearby well users as long as the restrictions are implemented effectively. Alternatives GA-3 and GA-4 offer a greater amount of protection by reducing VOC concentrations on-site. Alternatives 3 and 4 could be implemented without significant risks to on-site workers or the community, and without adverse environmental impacts. Neither alternative GA-3 or GA-4 is effective at reducing levels of inorganics in ground water. Alternatives GA-5 and GA-6 would offer greater protection to human health and the environment than GA-1 and GA-2, and similar protection to GA-3 and GA-4.

Long-term Effectiveness and Permanence

Alternatives GA-1 and GA-2 would have no effect on the contaminant concentrations contributing to the risks identified in the Baseline Risk Assessment. Therefore, any reduction in contaminant concentrations in the long-term would be due to natural dispersion, attenuation, and degradation processes. It is questionable whether remedial action objectives can be met through natural processes in the foreseeable future. Groundwater contamination would continue to be of potential risk to human health and the environment. The long-term effectiveness and permanence of GA-2 would depend on how effectively the deed restrictions can be implemented. For GA-3 and GA-4, effective and reliable performance would be expected from either air sparging system for

VOC removal. For GA-5 and GA-6, effective and reliable performance would be expected from either pump-and-treat system for the removal of VOCs and inorganics.

Reduction of Toxicity, Mobility, or Volume

Since Alternatives GA-1 and GA-2 provide no active treatment process, contaminants would degrade only by passive, natural processes. The toxicity and mobility of the contaminated groundwater may remain at current levels for an extended period of time. Both air sparging alternative (GA-3 and GA-4) and both pump-and-treat system alternatives (GA-5 and GA-6) would effectively reduce the toxicity, mobility, and volume of the contaminant plume.

Implementability

No implementation of Alternative GA-1 is needed. However, Alternatives GA-2, GA-3, GA-4, GA-5, and GA-6 would require extensive coordination between State and local agencies in order to implement the deed restrictions effectively. Alternatives GA-5 and GA-6 would require detailed planning as well as coordination with local agencies to determine the most viable discharge option.

Aquifer tests and additional characterization of the groundwater quality in the bedrock portion of the aquifer would be needed prior to implementation of the pump-and-treat systems for GA-5 and GA-6. Alternatives GA-5 and GA-6 are technically feasible, but following installation of the system, would require monitoring of the influent and effluent to determine the effectiveness of the system.

Cost

The wide range of estimated costs for the groundwater and soil alternatives are presented below in Tables 10-1 and 10-2, respectively.

TABLE 10-1

Summary of Costs for Evaluated Ground Water Remedial Alternatives

Remedial Alternative	Capital Costs	O&M Costs	Total Project Cost
GA-1:No Action	0	$55,240	$55,240
GA-2:Limited Action	$5,000	$2,826,940	$2,826,940
GA-3:Air sparging with passive venting	$1,032,500	$1,912,200	$2,944,700
GA-4:Air Sparging with Active Venting	$1,063,260	$1,966,940	$3,030,200
GA-5:Recovery, Precipitation/Filtration, & Carbon Absorption	$914,500	$7,537,060	$8,451,560
GA-6:Recovery, Precipitation/Filtration, Air Stripping, & Carbon Absorption	$934,950	$6,353,260	$7,288,710

TABLE 10-1

Summary of Costs for Evaluated Ground Water Remedial Alternatives

Remedial Alternative	Capital Costs	O&M Costs	Total Project Cost
SA-1:No Action	0	0	0
SA-2:Limited Action	$5,000	$0	$5,000
SA-3:Capping (entire site)	$12,500,000	$0	$12,500,000
SA-4:Excavation and Disposal (entire site)	$115,000,000	$0	$115,000,000
SA-5:Soil Vapor Extraction System2	$121,250	$955,670	$1,076,920

1. On-going monitoring costs are not considered to be O&M costs for soil remediation since these costs are already included in all GA options.

Modifying Criteria

State Acceptance

The NCDEHNR has reviewed and provided EPA-Region IV with comments on the Remedial Investigation and Feasibility Study reports. The NCDEHNR also reviewed this Record of Decision and EPA's preferred alternative and concurs with EPA's selection.

Community Acceptance

EPA received no comments during the 30-day comment period; therefore, there is no Responsiveness Summary.

XI. THE SELECTED REMEDY

Based on consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments, EPA has selected groundwater Alternative GA-4 and soil Alternative SA-5 for the Operable Unit Three Remedial Action at the FCX-Statesville Superfund Site. At the completion of this remedy, the risk associated with the Site is projected to be within 10E-4 to 10E-6, the risk range generally accepted by EPA to be protective of human health and the environment. The total present worth cost of Alternatives GA-4 and SA-5 is estimated to be $4,107,120 (assuming a 5% interest rate). Table 11-1 shows the capital costs associated with Alternative GA-4 and Table 11-2 shows the annual operating and maintenance costs associated with Alternative GA-4. Table 11-3 shows the capital costs associated with Alternative SA-5 while Table 11-4 shows the operating and maintenance costs for Alternative SA-5.

Ground Water Remediation

Ground water remediation will address the contaminated ground water at the Site. Ground water treatment will continue at the Site until the performance standards have been met. Ground water remediation will include designing and constructing a network of air sparging wells at and around the textile facility. Figure 11-1 shows the proposed location of the air sparging wells. The wells will be designed for maximum effectiveness. The system will be designed to operate 24 hours a day. System controls will allow complete automatic operation with minimal operator attention. The installation of a piping system will be necessary to transport the air into the aquifer.

The air sparging treatment system will require monitoring and maintenance. The performance standards for the air sparging system include meeting all state and federal ARARs. Long-term ground water monitoring will include sampling and analysis of the groundwater from the permanent monitoring wells on a semi-annual basis for 30 years or until groundwater remediation levels are met. Additional groundwater samples (unfiltered) will be collected and analyzed during the remedial design to ensure that levels of inorganics are not of concern. Groundwater samples will be analyzed for VOCs (EPA Method 8240), pesticides (EPA Method 8080), metals (EPA Method 6010), as well as a phthalate scan (EPA Method 8270) for cleanup verification purposes. Long-term groundwater monitoring will also be used to track contaminant plume migration, and to evaluate the progress of natural attenuation.

Groundwater contamination may be especially persistent in the immediate vicinity of the contaminants' source where concentrations are high. The ability of the air sparging treatment system to meet the groundwater remediation levels throughout the affected area, or the groundwater contamination plume, cannot be determined until the air sparging treatment system has been implemented, modified if necessary, and plume response monitored over time. If the selected treatment system cannot meet the specified performance standards, at any or all of the monitoring points during implementation, contingency measures and goals will be needed to supplement or replace the selected remedy. Such contingency measures, at a minimum, will prevent further migration of the plume, and include a combination of containment technologies and institutional controls, including deed restrictions. These measures are considered to be protective of human health and the environment, and are technically practicable under the corresponding circumstances.

TABLE 11-1
Cost Estimate for Air Sparging with Active Venting

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Pilot Study	1	lump sum	40,000
2	Installation of Sparge Points	20	7,250	145,000
3	Piping installation1			
	! Trenching for air distribution piping	4,090	25/ft	102,250
	! Distribution pipe	8,180	4.00/ft	32,720
	! Vent pipe	400	4.00/ft	1,600
	! Cuttings disposal	820 yd3	185.00/yd3	151,700
4	Blower multistage centrifugal, 35 psi output @ 150 scfm, w/ stand and ancillary equip.2	2	20,000	40,000
5	Vacuum blower, rotary lobe, positive displacement, 5 Hp	2	7,500	15,000
6	Air distribution manifold with control valves, sample ports, and flowmeter connections	20	1,500	30,000
7	Blower equipment shed	2	2,500	5,000
8	Equipment shed concrete pad	2	3,000	6,000
9	Deed Restriction	1	5,000	5,000
	Subtotal			574,270
10	Mobilization/demobilization, construction management (20%)			114,850
11	Designs, specifications, regulatory approval, and permits (20%)			114,850
	Subtotal			803,970
12	Administration (15%)			120,600
	Subtotal			924,570
13	Contingency (15%)			138,690
	Total Capital Cost (rounded)			1,063,260

Quantity of pipe required and length of trench based on tentative placement of sparge points and treatment system equipment pad.

1. Final blower sizing will depend on the results of the pilot study.

TABLE 11-2
O&M Cost Estimate for Air Sparging with Active Venting

Item	Description	Annual Quantity	Total Unit Cost ($)	Cost/yr ($)
1	Labor (est. at 5% of Capital Equipment cost)		lump sum	28,700
2	Maintenance (est. at 2% of Capital Cost)		lump sum	11,480
3	Semi-annual Ground water monitoring (see GA-2)			125,420
4	Utilities			
	! electricity (40 Hp equivalent)		262,800	0.06/KWHR
		KWHR	15,770	
	Subtotal			181,370
5	Administrative (15%)			27,200
	Subtotal		208,580	
6	Contingency (15%0		31,300	
	Total O&M Cost per year			239,880
7	Site Review by EPA, every 5 years			55,640
	Present Worth Cost (rounded)1			1,966,940
	Total Alternative Cost			3,030,200

1. Present worth costs assume total O&M cost per year for 10 years and a money discount rate of 5%.

TABLE 11-3
Capital Cost Estimate for Soil Vapor Extraction System[1]

Item	Description	Quantity	Unit Cost($)	Total Cost ($)
1	Pilot Study	1	lump sum	7,500
2	Installation of Extraction Points	3	5,000	15,000
3	Piping, linear[1]			
	! Trenching for air distribution piping	250	25/ft	6,350
	! Distribution pipe	600	4.00/ft	2,400
4	Blower, rotary lobe type, capable of 10 inch Hg vacuum at 100 scfrm, w/ stand and ancillary equip.[2]	1	10,000	10,000
5	Air collection manifold with control valves, sample ports, and flowmeter connections	9	1,500	13,500
6	Vacuum blower equipment shed	1	2,500	2,500
7	Equipment shed concrete pad	1	3,000	3,000
8	Deed Restriction	0	5,000	0
	Subtotal		60,250	
9	Mobilization/demobilization, construction management (20%)			12,050
10	Designs, specifications, regulatory approval, and permits (20%)			12,050
	Subtotal		84,350	
14	Administration (15%)			12,650
	Subtotal		97,000	
15	Contingency (25%)		24,250	
	Total Capital Cost (rounded)			121,250

1. These costs assume installation of a VES system independently of air sparging. If GA-4 is the selected remediation option, essentially all costs for the VES system are contained within that option and additional VES points will only minimally impact total project costs.

2. Final blower sizing will depend on the results of the pilot study.

TABLE 11-3
Capital Cost Estimate for Soil Vapor Extraction System

Item	Description	Quantity	Unit Cost($)	Total Cost ($)	
1	Labor (est. at 5% of Capital Equipment cost)		lump sum	4,220	
2	Maintenance (est. at 2% of Capital Cost)		lump sum	1,700	
3	Semi-annual Ground water monitoring (see GA-2)			125,420	
4	Utilities				
	! electricity (7 Hp equivalent)		46,000	0.06/KWHR	2,760
	Subtotal			134,100	
6	Contingency (25%)			38,500	
	Total O&M Cost per year			192,715	
	Present Worth of O&Mcost			834,420	
	Total Alternative Cost			955,670	

1. Present worth costs assume total O&M cost per year for 5 years and a money discount rate of 5%.

In order to address areas of the ground water contamination plumes with low levels of VOCs, ground water will be collected and evaluated during the remedial design to determine if natural attenuation is taking place. Long-term monitoring of the groundwater entering and exiting the air sparging system will also be required. Monitoring of the ground water discharging as surface water at the seep will be required to ensure that no future unacceptable risks occur. The following analytical parameters should be added to the current list of analytes to be monitored for natural attenuation: dissolved oxygen, nitrate, iron (II), sulfate, sulfide, methane, oxidation reduction potential, pH, temperature, chloride, and all other daughter products of perchloroethene (trichloroethene, dichloroethene, vinyl chloride, ethene/ethane, and chloroethane. Additional parameters may be added to accurately determine if biodegradation is occurring. These parameters include dissolved organic carbon, carbon dioxide, alkalinity, hydrogen, and volatile fatty acids. Once the information is collected, simulating natural attenuation using a fate and transport model is needed to predict the migration and attenuation of the contaminant plume through time. If it is determined that natural attenuation will not result in the attainment of the remediation levels or performance standards, it may be necessary to reopen the remedy.

The Remedial Action shall comply with all ARARs shown in Tables 7-1 and 7-2, including the ground water remediation levels shown in Table 8-1. The presence of contamination in the ground water will require deed restrictions to document their presence and could limit future use of any area(s) known to be affected by the contaminated groundwater. The extent of the property restrictions and limitations will be determined during the Remedial Design.

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Soil Remediation

Soil remediation will address the VOC contamination in the soil at the Site. Soil remediation will continue until VOC concentrations have been reduced such that the ground water performance standards have been met. Soil remediation will include designing and constructing a network of vapor extraction wells in the contaminated portion of the unsaturated zone on and around the textile facility. Figure 9 shows the proposed locations for the soil vapor extraction wells. The system is designed to operate 24 hours a day. System controls will allow complete automatic operation with minimal operator attention. Refer to the Feasibility Study and the Upcoming Remedial Design for details.

The soil vapor extraction treatment system will require monitoring and maintenance. The objective of the soil vapor extraction system is to reduce the amount of volatile organic compounds in the soil as a source of groundwater contamination. Periodic sampling of the soil will be required to monitor the progress of the soil vapor extraction system

XII. STATUTORY DETERMINATION

Based on available information, the selected remedy satisfies the remedy selection requirements under CERCLA, as amended by SARA, and the NCP. The selected remedy provides protection of human health and the environment, is cost-effective, utilizes permanent solutions to the maximum extent practicable, and satisfies the statutory preference for remedies involving treatment technologies.

Protection of Human Health and the Environment

The selected remedy will permanently treat the ground water and remove the potential risk associated with the ground water contamination. The ingestion and inhalation contact with Site contaminants would be eliminated. The selected remedy will also permanently treat the contaminated soil, thereby reducing the source of groundwater contamination.

Compliance with ARARs

The selected remedy will comply with all Federal and State ARARs. No waivers of Federal or State requirements are anticipated for this Site at this time.

Cost Effectiveness

The selected groundwater technologies are more cost-effective than the other acceptable alternatives considered. The selected remedies provide greater benefit for the cost because they permanently treat the waste.

Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and treatment can be practicably utilized for this Remedial Action.

Of the alternatives that are protective of human health and the environment and comply with ARARs, EPA and the State have determined that the selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness, implementability, and cost; State and community acceptance, and the statutory preference for treatment as a principal element.

Preference for Treatment as a Principal Element

The preference for treatment is satisfied by the use of air sparging with active venting for treatment of contaminated ground water, and soil vapor extraction for treatment of contaminated soil. The principal threats at the Site will be mitigated by the use of these treatment technologies.

Appendix A

State of North Carolina <IMG 0496276K>
Department of Environment
Health and Natural Resources
Division of Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

26 September 1996
Mr. Ken Mallary
Superfund Branch
US EPA Region IV
100 Alabama Street
Atlanta, Georgia 30303

RE: Conditional State Concurrence with the Record of Decision (ROD)
FCX, Inc. (Statesville) OU-3
Statesville, Iredell County

Dear Mr. Mallary,

The North Carolina Superfund Section has received and reviewed the attached Record of Decision (ROD) for the FCX, Inc. (Statesville) OU-3 Superfund Site and concurs with the selected remedy subject to the following conditions:

1. Our concurrence on this ROD and of the selected remedies for the site is based solely on the information contained in the attached ROD and to the conditions listed here. Should we receive additional information that significantly affects the conclusions or remedies contained in the ROD, we may modify or withdraw this concurrence with written notice to EPA Region IV.

2. Our concurrence on this ROD in no way binds the State to concur in future decisions or commits the State to participate, financially or otherwise, in the cleanup of the Site. The State reserves the right to review, comment, and make independent assessments of all future work relating to this Site.

3. If, after remediation is complete, the total residual risk level exceeds 10-6, the State may require deed recordation/restriction to document the presence of residual contamination and possibly limit future use of the property as specified in NCGS 130A-310.8.
<IMG 0496276L>
We appreciate the opportunity to comment on this ROD and look forward to continuing to work with the EPA to remediate this Site.

Sincerely,
<IMG 0496276M>

Jack Butler, PE
Section Chief
Superfund Section
Attachment
cc: Mike Kelly
Philip A. Vorsatz